

REMARKS

Favorable reconsideration and allowance of the claims of the present application are respectfully requested.

In the present Office Action, Claims 1-31 stand rejected under 35 U.S.C. § 112, second paragraph, as allegedly indefinite for failing to particularly point out and distinctly claim the subject matter which the applicants regard as their invention. The specific grounds for the indefiniteness rejection are described in detail at Page 2 of the present Office Action.

In response to the indefiniteness rejection, applicants have amended Claims 1, 3, 6, 7, 8, 9, 29, 30 and 31 in the manner indicated above. Specifically, applicants have amended Claim 1, line 4 to positively recite that an *amorphized region* is formed. This language provides antecedent basis for the same language found in line 5 of the original claim. With regard to Claim 3, applicants have changed the term "comprising" to "comprises" as suggested by the Examiner in the present Office Action. In Claim 6, applicants have cancelled the first occurrence of the term "Si".

With respect to Claims 7, 8, 9, 30 and 31, applicants have changed the term "energetic ions" to "ions"; in Claim 7 the phrase "that are capable of forming said amrophized region" has been added to specify the type of ions that can be used.

Concerning the indefiniteness rejection to Claim 29, applicants have corrected the spelling of the term "amorphizing". Applicants have amended Claims 30 and 31 by deleting the term "amorphized" in front of the phrase "defective semiconductor material" and by replacing the term "amorphous region" with "amorphized region".

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Applicants respectfully submit that the above amendments to the claims obviate the indefiniteness rejection under 35 U.S.C. § 112, second paragraph. Thus, reconsideration and withdrawal of the § 112, second paragraph rejection are respectfully requested.

Applicants acknowledge, with thanks, the Examiner's indication that Claims 5, 12-14, 25, 26, 28 and 29 would be allowable if rewritten to overcome the rejection under 35 U.S.C. § 112, second paragraph, and to include all of the limitations of the base claim and any intervening claim. Despite this indication of allowable subject matter, applicants have not amended the broad claims to include the allowable subject matter. Instead, applicants have amended Claims 1, 30 and 31 to positively recite that the defective semiconductor material comprises *a heterostructure containing epitaxial growth-related defects* that are reduced using the inventive process. Support for this amendment to Claims 1, 30 and 31 is found throughout the specification of the instant application. See, in particular, cancelled Claim 2 and Page 3, paragraph [0010] of the specification of the instant application.

Applicants have further amended Claims 1, 30 and 31 to positively recite that the amorphized region does not extend to a buried insulating layer within said defective crystal material. Support for this amendment to Claim 1 is also found within paragraph [0100] of the specification of the instant application.

Applicants observe that the above amendments to the claims should be entered since they do not introduce new matter into the specification of the instant application.

Claims 1, 2, 6, 7, 8, 19, 17-20, 27 and 30 stand rejected under 35 U.S.C. § 102(a) as allegedly anticipated by U.S. Patent No. 6,528,387 to Moriyasu, et al. ("Moriyasu, et al."). Claims 3, 4, 9, 11, 15, 16, 21-24 and 31 stand rejected under 35 U.S.C. § 103 as allegedly

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unpatentable over the combined disclosures of Moriyasu, et al., U.S. Patent No. 6,689,671 to Yu, et al. ("Yu, et al.") and U.S. Patent No. 4,617,066 to Vasudev ("Vasudev").

Concerning the § 102(a) rejection, it is axiomatic that anticipation under § 102 requires that the prior art reference disclose each and every element of the claim to which it is applied. In re King, 801 F.2d, 1324, 1326, 231 USPQ 136, 138 (Fed. Cir. 1996). Thus, there must be no differences between the subject matter of the claim and the disclosure of the prior art reference. Stated another way, the reference must contain within its four corners adequate direction to practice the invention as claimed. The corollary of the rule is equally applicable: Absence from the applied reference of any claimed element negates anticipation. Kloster Speedsteel AB v. Crucible Inc., 793 F.2d 1565, 1571, 230 USPQ 81, 84 (Fed. Cir. 1986).

Applicants respectfully submit that the claimed methods of the present application are not anticipated by the disclosure of Moriyasu, et al. for at least the following reasons. First, Moriyasu, et al. do not disclose a method in which an amorphized region does not extend to a buried insulating layer within a defective semiconductor crystal material that comprises a heterostructure, as presently recited in the claims of the present application. In contrast, in the method disclosed in Moriyasu, et al. wherein Si ions are implanted, the Si ions are implanted into the first Si layer 2 to make a deep portion 8 amorphous. As shown in prior art FIGS. 4A-4F, the amorphized region 8 extends to the single crystalline oxide substrate 1. Hence, in the prior art the amorphized region is in contact with an insulating layer. This is not that case in the claimed methods wherein it is now recited that the amorphized region does not extend to a buried insulating layer within said defective crystal material. Applicants submit that the disclosure of Moriyasu, et al. thus teaches away from the claimed invention requiring that the amorphized region be in contact with the insulating layer.

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Applicants further observe that in the prior art, the second semiconductor layer 5 is grown atop a seed Si layer which constitutes the Si layer 2 mentioned above that is formed in the above manner. The Si layers 2 and 5 do not constitute a heterostructure, as presently claimed, and even if they did, the amorphization implant occurs prior to the formation of layer 5.

In addition to the above distinguishing features, Moriyasu, et al. do not disclose that their methodology can be used to reduce epitaxial growth-related defects in a defective semiconductor crystal material, as presently claimed. In Moriyasu, et al., the methods reduce the crystalline defect density, not the epitaxial grown defect density of a heterostructure as claimed.

The foregoing remarks clearly demonstrate that the applied references do not teach each and every aspect of the claimed invention, as required by King and Kloster Speedsteel; therefore the claims of the present application are not anticipated by the disclosure of Moriyasu, et al. Applicants respectfully submit that the instant § 102 rejection has been obviated and withdrawal thereof is respectfully requested.

With respect to the obviousness rejection, applicants submit that the combined disclosures of Moriyasu, et al., Yu and Vasudev do not render the claimed methods obvious since the combined references do not teach or suggest the features recited in the independent claims of the present application. Specifically, the combined disclosures do not teach or suggest a method whereby an amorphized region is first created in a defective semiconductor material comprising a heterostructure such that it does not extend to a buried insulating layer and then heating the structure to reduce epitaxially grown defects that are present in the defective semiconductor material.

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Applicants submit that Moriyasu, et al. are defective for the reasons mentioned above under the anticipated rejection. Thus, applicants incorporate those remarks herein by reference. To reiterate: Moriyasu, et al. teach and suggest a method in which the amorphized region is in contact with a buried insulating layer. This is opposite to the claimed invention in which it is specifically recited that the amorphized region does not extend to a buried insulating layer within the defective semiconductor material. Thus, the primary reference teaches away from the claimed invention. Applicants thus submit that Moriyasu, et al. require that the amorphized region be formed in contact with the insulating layer. Moreover, Moriyasu, et al. do not teach or suggest that the disclosed methods can be used for reducing epitaxially grown defects that are formed in a semiconductor crystal material that includes a heterostructure. Applicants observe that the term epitaxial growth-related defects are not mentioned in the disclosure.

Yu, et al. do not alleviate the above defects in Moriyasu, et al. Applicants note that Yu, et al. disclose a method of fabricating a semiconductor device with source/drain regions that are preamorphized in such a way to allow recrystallization of a Si/SiGe layer in a manner that recovers the original strain. This is known to those skilled in the art as a method of fabricating abrupt source/drain junctions. Applicants observe that while Yu, et al. disclose forming the preamorphized region within semiconductor layer 2 (i.e., a shallow preamorphized region), the secondary reference does not teach or suggest that the methodology employed therein can be used to reduce epitaxial induced defects, as presently claimed. The purpose of the shallow implant in Yu, et al. is to form abrupt S/D junctions that have reduced channeling effects. Nowhere in the secondary reference of Yu, et al. is there mention of growth-induced defects. Applicants submit that the combined disclosures of

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Moriyasu, et al. and Yu, et al. would result in a method in which the process disclosed in Moriyasu, et al. is used to form a layered semiconductor material atop insulating material 1 and then the method of Yu, et al. would be used in forming abrupt S/D junctions in the layered semiconductor material.

Vasudev does not alleviate the above defects in Moriyasu, et al. and Yu, et al. since the applied reference also does not teach or suggest applicants' claimed sequence of processing steps which reduce epitaxial growth-related defects in a defective semiconductor crystal material that includes a heterostructure. Applicants observe that in Vasudev a single semiconductor layer is formed atop a sapphire substrate; Vasudev does not teach or suggest a heterostructure as presently claimed. Moreover, the method disclosed in Vasudev is used to form hyperabrupt retrograde S/D junctions, not to cause a reduction in epitaxial growth-related defects in a heterostructure, as presently claimed.

The § 103 rejection also fails because there is no motivation in the applied references which suggest modifying the disclosed methods to include applicants' claimed methods whereby epitaxial growth-related defects in a heterostructure are reduced using the sequence of processing step mentioned in the present application. Thus, there is no motivation provided in the applied references, or otherwise of record, to make the modification mentioned above. "The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification." In re Vaack, 947 F.2d, 488, 493, 20 USPQ 2d. 1438, 1442 (Fed.Cir. 1991).

The rejection under 35 U.S.C. § 103 has been obviated; therefore reconsideration and withdrawal thereof is respectfully requested.

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Thus, in view of the foregoing amendments and remarks, it is firmly believed that the present case is in condition for allowance, which action is earnestly solicited.

Respectfully submitted,



Leslie S. Szivos, Ph.D.  
Registration No. 39,394

Scully, Scott, Murphy & Presser  
400 Garden City Plaza  
Garden City, New York 11530  
(516) 742-4343

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